

299-W18-156 (A7639) Log Data Report

Borehole Information:

Borehole: 299-W18-156 (A7639)			Site: 216-Z-12 Crib		
Coordinates (WA St Plane)		GWL¹ (ft): None	GWL Date: 10/17/06		
North (m)	East (m)	Drill Date	Ground Level Elevation	Total Depth (ft)	Type Cable
135491.761	566359.564	08/76	684.16	26.0	

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel	0.0	10 3/4	10	3/8	0.0	26

Borehole Notes:

The logging engineer measured the casing stick-up and diameter using a caliper and steel tape. Logging data acquisition is referenced to the TOC, which is at the ground surface. The driller's log indicates contamination at 17.5 ft.

Logging Equipment Information:

Logging System: Gamma 4E		Type: SGLS (70%) SN: 34-TP40587A
Effective Calibration Date: 05/08/06	Calibration Reference: DOE-EM/GJ1199-2006	
Logging Procedure: MAC-HGLP 1.6.5, Rev. 0		

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 Repeat	3 Repeat		
Date	10/17/06	10/17/06	10/17/06		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	23.0	23.0	23.0		
Finish Depth (ft)	0.0	18.0	23.0		
Count Time (sec)	200	400	1000		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A ²	N/A	N/A		
Pre-Verification	DEE01CAB	DEE01CAB	DEE01CAB		
Start File	DEE01000	DEE01024	DEE01030		
Finish File	DEE01023	DEE01029	DEE01030		
Post-Verification	DEE01CAA	DEE01CAA	DEE01CAA		
Depth Return Error (in.)	0	N/A	0		
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.		

Logging Operation Notes:

Logging was conducted with a centralizer on the sonde and measurements are referenced to top of casing. Repeat data were acquired at 1000 second counting time at 23.0 ft and at 400 seconds from 18 to 23 ft to provide additional detail of the highest activity zone. For purposes of this report, data acquired with the longest counting times are included as the main log data.

Analysis Notes:

Analyst:	Henwood	Date:	10/25/06	Reference:	GJO-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verifications for the SGLS were performed before and after the day's data acquisition. The acceptance criteria were met.

A casing correction for 3/8-in.-thick casing was applied throughout the borehole.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with an EXCEL worksheet template identified as G4EMay06.xls using an efficiency function and corrections for casing and dead time as determined from annual calibrations.

Results and Interpretations:

^{237}Np is detected with the SGLS by measuring a daughter product (protactinium-233 (^{233}Pa)) that emits relatively prominent gamma rays at energy peaks of 300.34, 312.17, 340.81, 375.45, 398.62, and 415.76 keV. The 312.17 keV gamma line exhibits the highest yield (38.6 %) and is used to determine the concentration for ^{233}Pa . ^{233}Pa was detected from 18 and 23 ft and at 1 and 2 ft. The maximum concentration is 11 pCi/g at a depth of 23 ft.

A slightly elevated ^{232}Th concentration as determined using the 2615 keV (^{208}Tl) energy peak, is indicated at 18 ft. The plot of natural gamma logs shows the disruption of the equilibrium of the natural ^{232}Th decay, where at 18 ft the ^{228}Ac indicates ^{232}Th concentrations below that calculated from the 2615 keV gamma line. This difference is attributed to the existence of ^{232}U . To determine the concentration of ^{232}U , the activity due to natural decay of ^{232}Th must be subtracted. The ^{228}Ac concentration is subtracted from the ^{232}Th concentration calculated based on the 2615 keV ^{208}Tl energy peak. The result is a maximum concentration of approximately 0.5 pCi/g ^{232}U . Given the total error of the measurements, this difference may not be statistically significant at this borehole. However, data from nearby boreholes exhibit the same characteristic where the determination of ^{232}U is more definitive at approximately the same depth.

^{233}U almost certainly exists where ^{232}U is detected. In a reactor using thorium target material, ^{233}U will be generated at two to three orders of magnitude more than ^{232}U . However, at relatively low concentrations, ^{233}U and its decay products emit few gamma rays that can be detected with the SGLS. Decay products that potentially could be measured, have not had sufficient time to grow into equilibrium with their parent so that detection is possible. It is inferred on the basis of the probable ^{232}U concentration that less than 200 pCi/g ^{233}U may exist in this waste stream.

Repeat sections indicate good repeatability for the manmade and naturally occurring radionuclides.

Spectral gamma data were acquired in this borehole in 1998 by Waste Management Federal Services NW using the Radionuclide Logging System (RLS). A comparison plot of the RLS (1998) and SGLS (2006) manmade radionuclides show similar concentrations for ^{233}Pa . Data analysis for the 1998 data did not identify ^{232}U or ^{233}U as potential contaminants.

The RLS analysis indicated ^{239}Pu from 22 to 23.5 ft at a maximum concentration of 12,000 pCi/g. The current SGLS analysis did not identify ^{239}Pu . It is believed the RLS analysis incorrectly attributed an approximate 414 keV gamma line to ^{239}Pu , which emits a 413.71 keV gamma line. The current analysis attributes the 414 keV gamma line to ^{233}Pa , which has a gamma line at 415.76 keV. The assay for ^{233}Pa using this line compared with the 312.17 keV ^{233}Pa gamma line is approximately the same.

References:

Kasper, R.B., 1982. *216-Z-12 Transuranic Crib Characterization: Operational History and Distribution of Plutonium and Americium*, RHO-ST-44, Rockwell International, Richland, Washington.

List of Log Plots:

Depth scale: 1"=20 ft except for repeat logs or as noted

Man-Made Radionuclide Plot

Natural Gamma Logs

Combination Plot (0-120 ft)

Combination Plot (0-60 ft)

Total Gamma & Dead Time

SGLS/RLS Manmade Comparison Plot

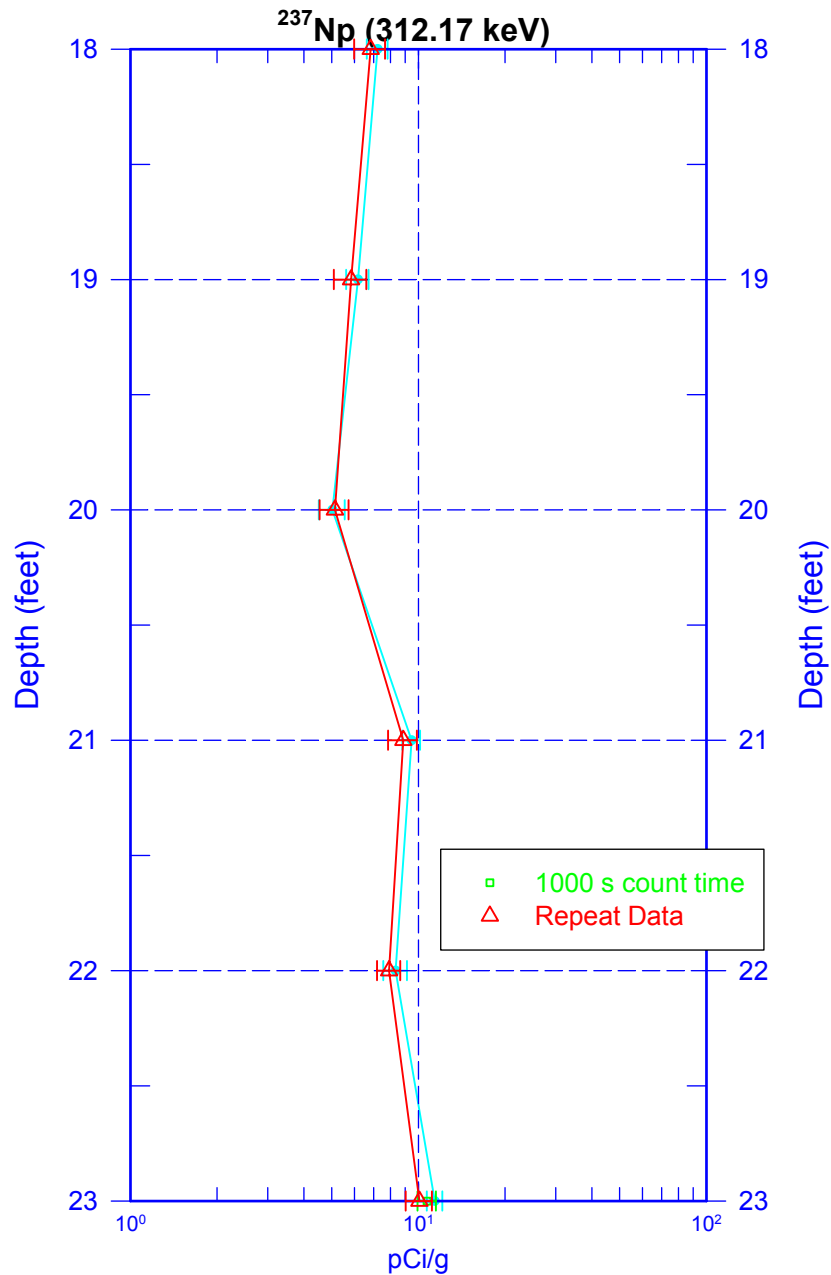
Repeat of Manmade Radionuclide Plot

Repeat of Natural Gamma Logs

¹ GWL – groundwater level

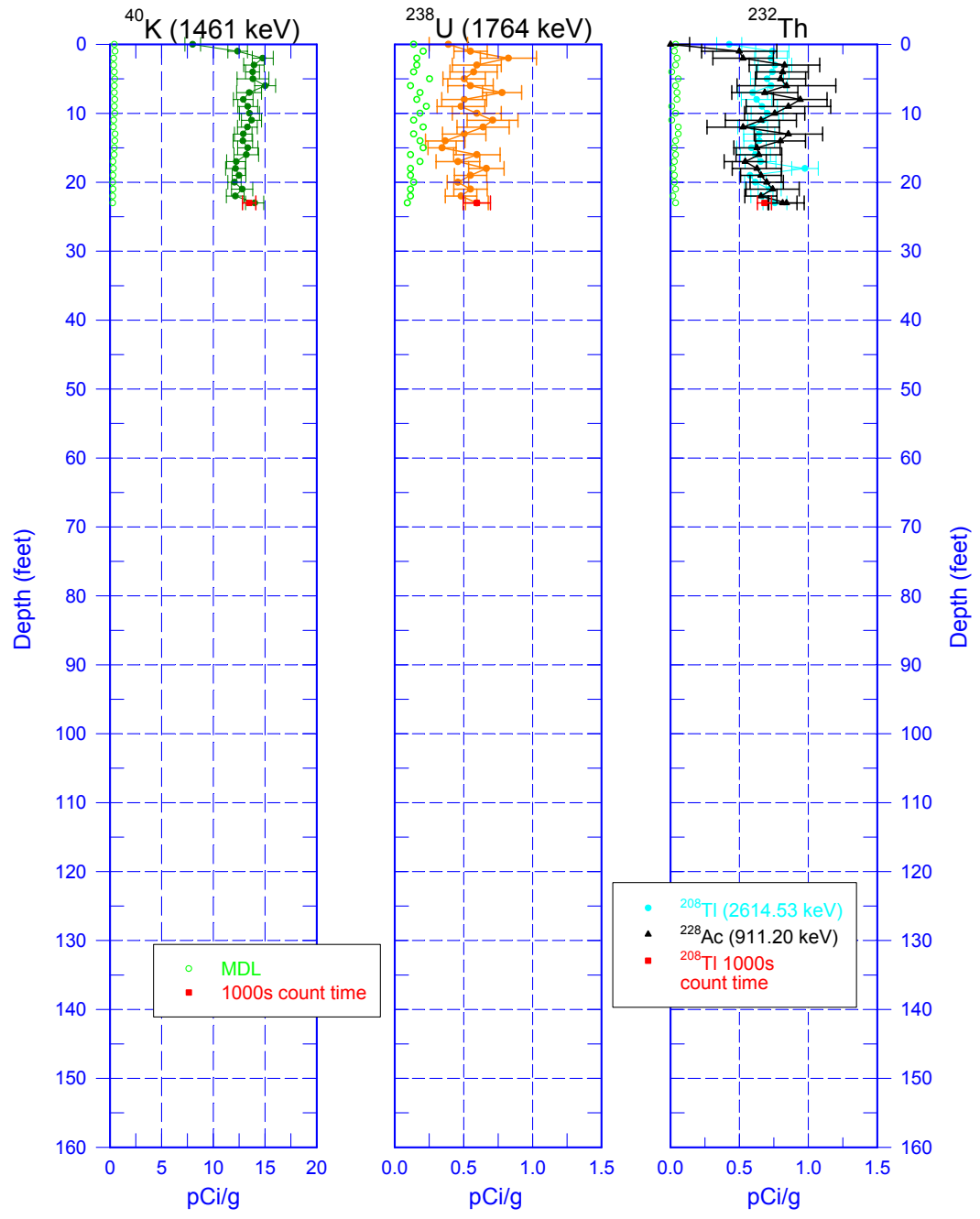
299-W18-156 (A7639)

Repeat of Manmade Radionuclide Plot



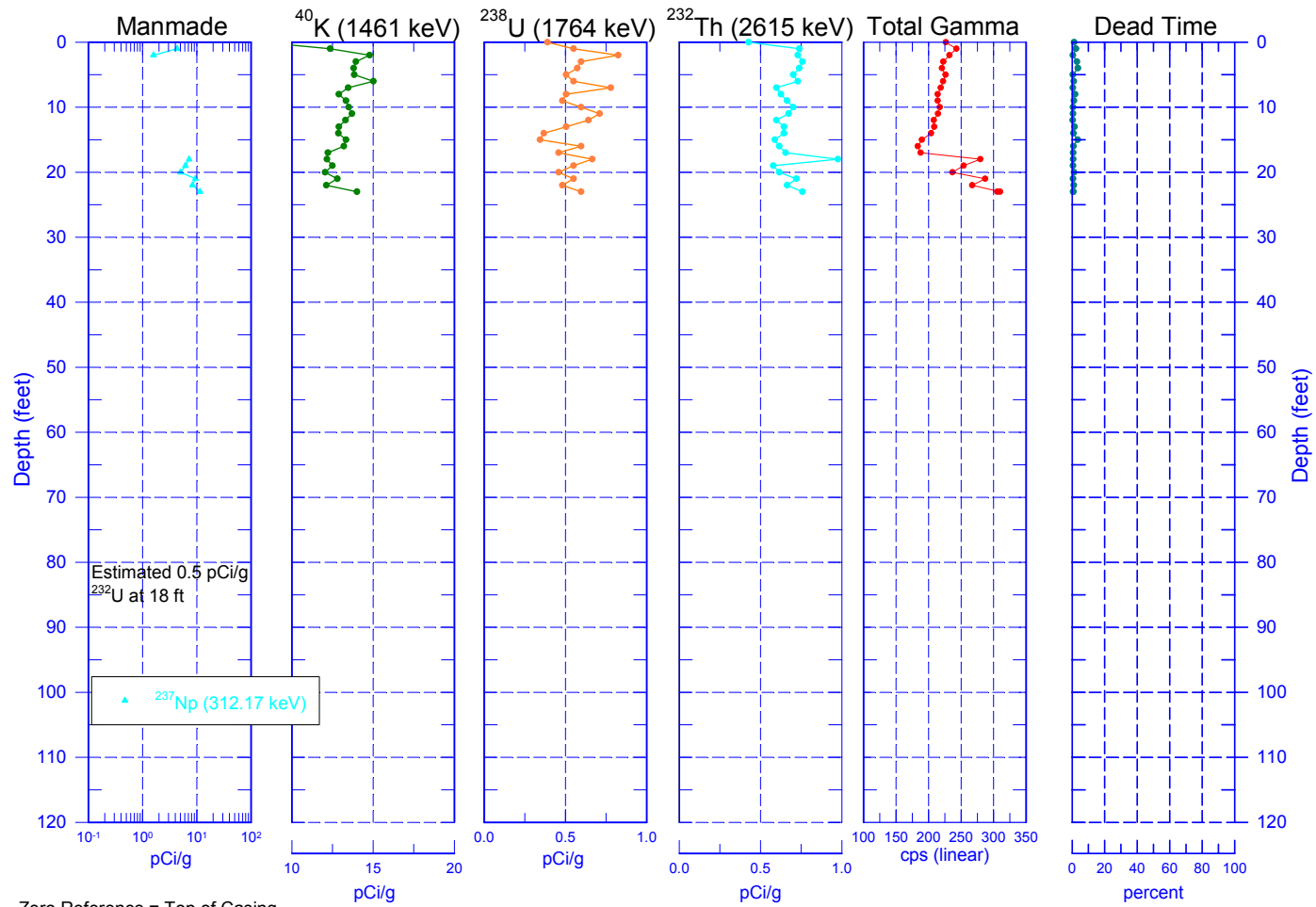
Zero Reference = Top of Casing

299-W18-156 (A7639) Natural Gamma Logs

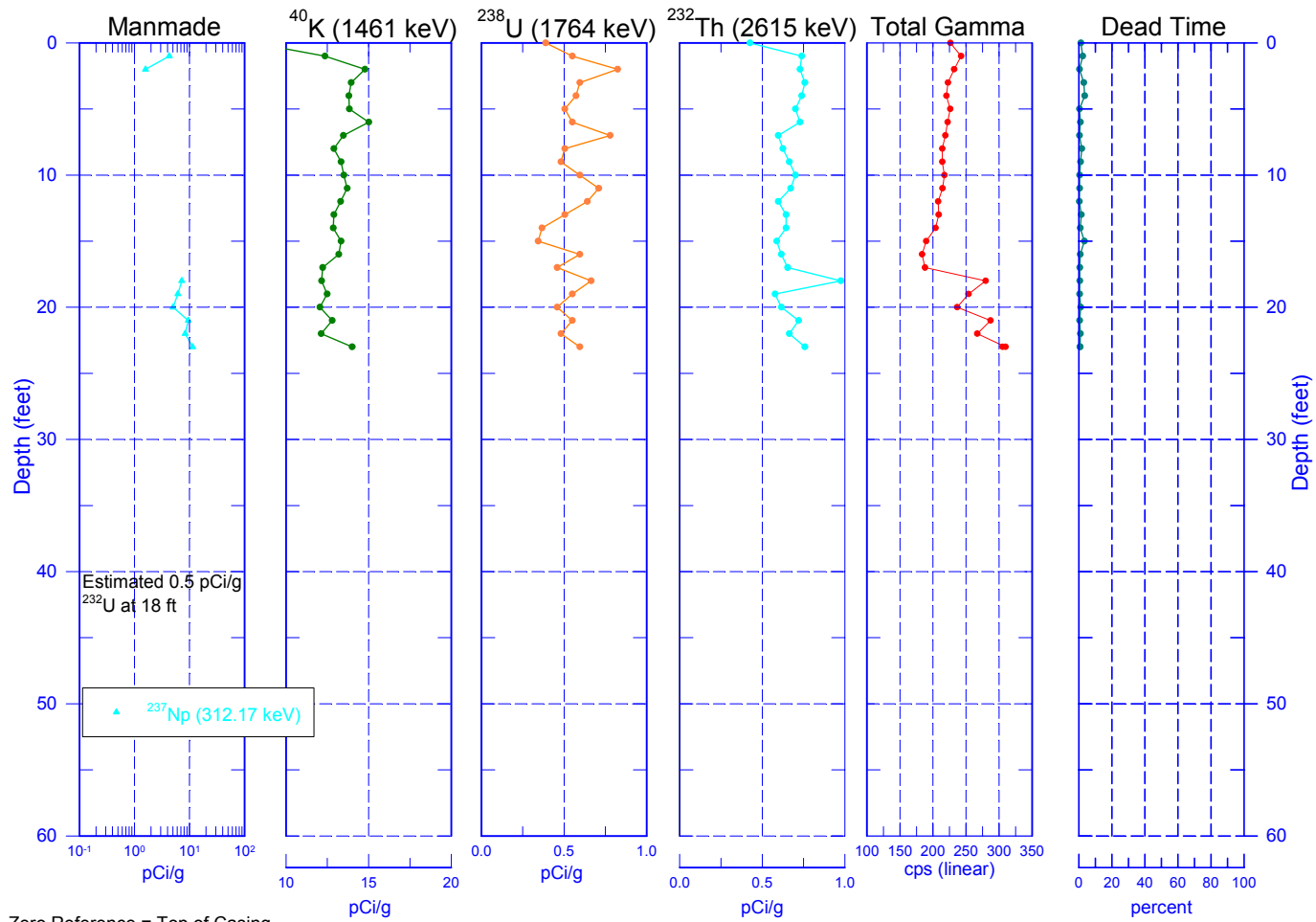


Zero Reference = Top of Casing

299-W18-156 (A7639) Combination Plot

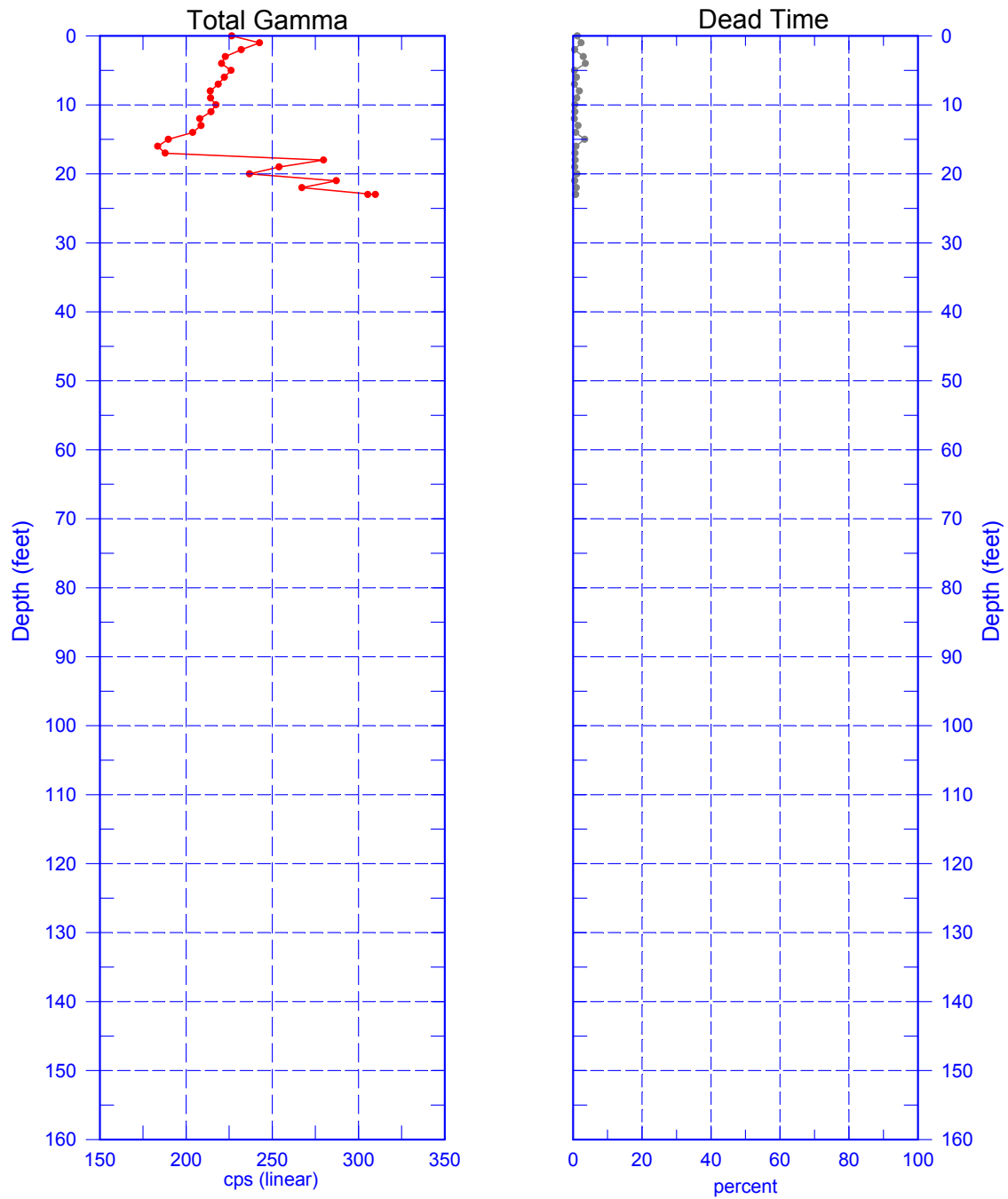


299-W18-156 (A7639) Combination Plot



299-W18-156 (A7639)

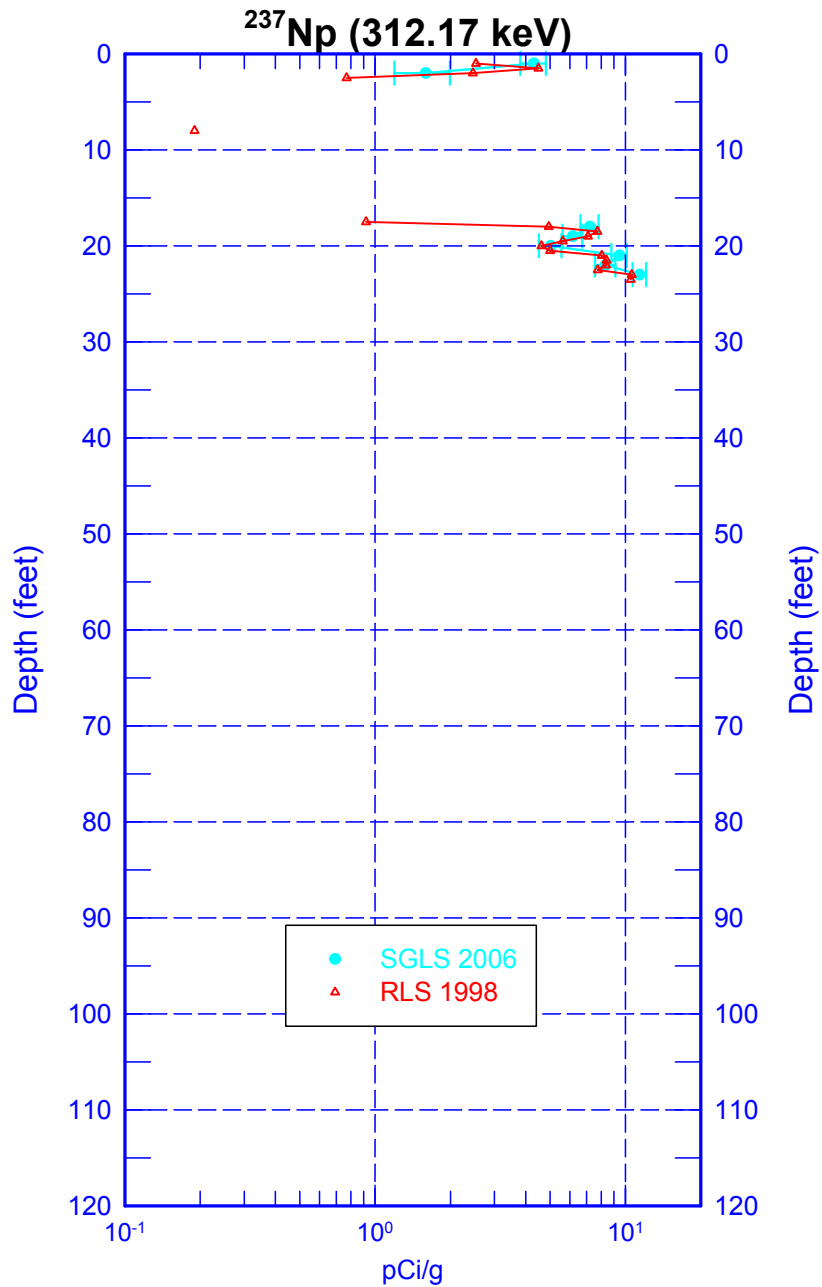
Total Gamma & Dead Time



Reference - Top of Casing

299-W18-156 (A7639)

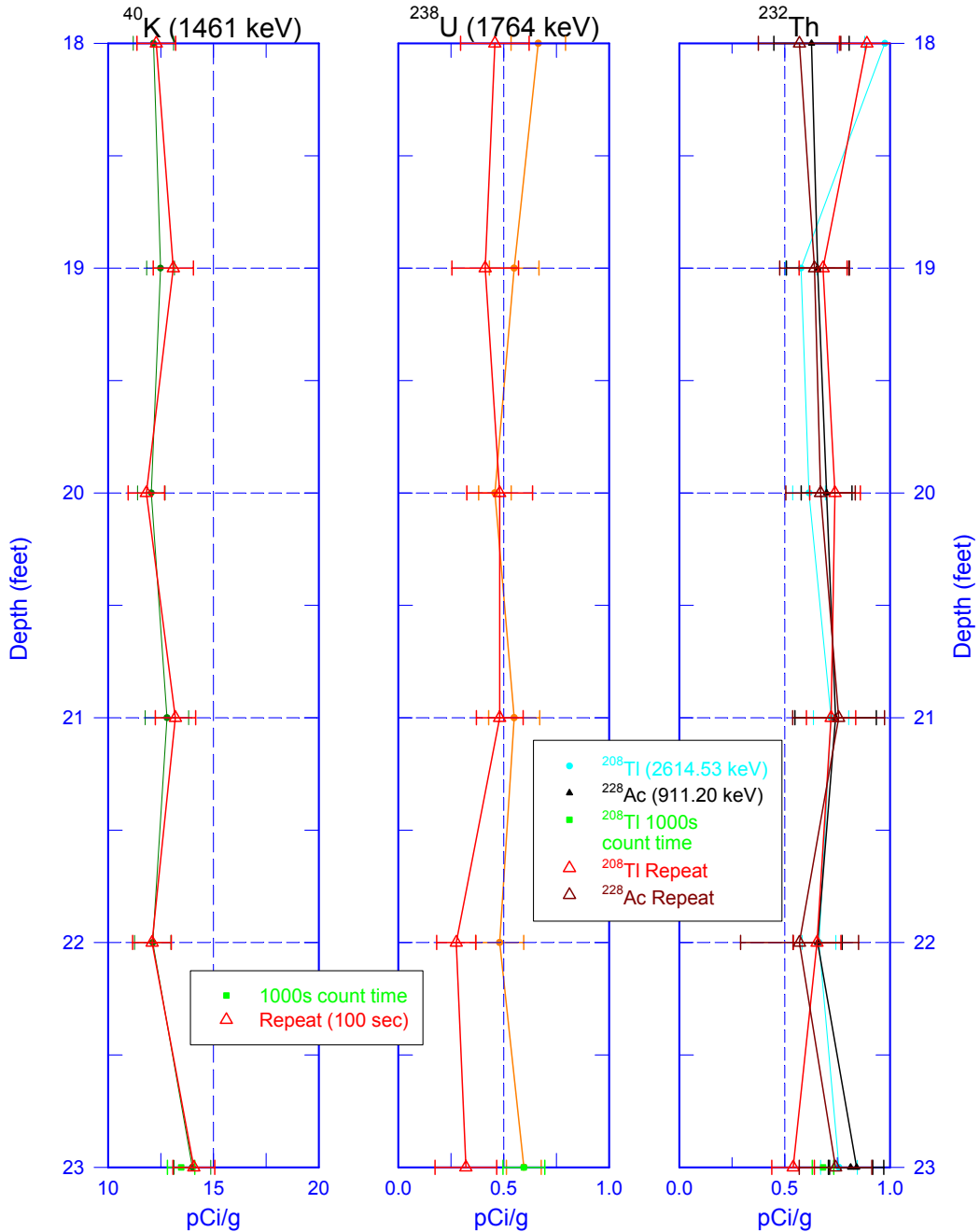
SGLS/RLS Manmade Comparison Plot



Zero Reference = Top of Casing

299-W18-156 (A7639)

Repeat of Natural Gamma Logs



Zero Reference = Top of Casing

299-W18-156 (A7639)

Repeat of Manmade Radionuclide Plot

